CLAIMS

1. A protein crystal detection apparatus for detecting a protein crystal contained in a protein solution held in a crystallization vessel, the protein crystal detection apparatus comprising:

an observation stage on which a crystallization vessel to be observed is set;

a camera for photographing a plurality of cross sections of the protein solution on the observation stage at different positions in a focusing direction, thereby capturing a plurality of layer images;

an observed-image storage for storing the plurality of layer images captured by the camera;

a crystal characteristic image formation part for forming a crystal characteristic image for each of the layer images by extracting a characteristic portion of the protein crystal from each of the layer images stored in the observed-image storage;

a layer information extraction part for determining layer information for each of the layer images by digitizing the characteristic portion of the protein crystal contained in the crystal characteristic image; and

a crystallization determination part for determining growth status of the protein crystal contained in the protein solution based on the layer information of each layer image alone and correlation of the layer information between the cross

sections of adjacent ones of the layer images.

2. The protein crystal detection apparatus of claim 1, wherein

the crystal characteristic image is a binary image formed by extracting the characteristic portion of the protein crystal; and

the layer information includes at least a number of pixels corresponding to the characteristic portion of the protein crystal and a number of labels which are each a block of the pixels in the binary image.

3. The protein crystal detection apparatus of claim 1 or 2, wherein the crystallization determination part determines a presence or absence of a protein crystal and a product other than the protein crystal.

4. A protein crystal detection method for detecting a protein crystal contained in a protein solution held in a crystallization vessel, the protein crystal detection method comprising:

an image capturing process for photographing a plurality of cross sections of the protein solution at different positions in a focusing direction on an observation stage on which a crystallization vessel to be observed is set, thereby capturing a plurality of layer images;

an image storage process for storing the plurality of layer images thus captured;

a crystal characteristic image formation process for forming a crystal characteristic image for each of the layer images by extracting a characteristic portion of the protein crystal from each of the layer images;

a layer information extraction process for determining layer information for each of the layer images by digitizing the characteristic portion of the protein crystal contained in the crystal characteristic image; and

a crystallization determination process for determining growth status of the protein crystal contained in the protein solution based on the layer information of each layer image alone and correlation of the layer information between the cross sections of adjacent ones of the layer images.

5. The protein crystal detection method of claim 4, wherein

the crystal characteristic image formation process forms a binary image by extracting the characteristic portion of the protein crystal; and

the layer information includes at least a number of pixels corresponding to the characteristic portion of the protein crystal and a number of labels which are each a block of the pixels in the binary image.

6. The protein crystal detection method of claim 4 or 5, wherein

the crystallization determination process determines a presence or absence of a protein crystal and a product other than the protein crystal.